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# A New Species of *Votomita* (Melastomataceae) from Venezuela, with Thoughts on Ovule and Seed Number and Seed Size

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**ABSTRACT.** A new species of *Votomita* from southern Venezuela is described, illustrated, and distinguished from its relatives on the basis of fruiting material; certain useful floral characters can also be determined from the specimen. The new species illustrates a general condition in subfamily Memecyleae, i.e., a relatively large number of ovules is produced yet only one or a few large seeds are formed. Ovule and seed numbers are discussed, seed volumes are calculated for *Mouriri* and *Votomita*, and possible explanations for the differences are explored.

***Votomita ventuarensis* Morley, sp. nov.** TYPE: Venezuela. Terr. Fed. Amazonas: Dept. Atabapo, bosques medios y bajos inundables en el rio Ventuari-Macabana, 4°15'N, 66°20'W, 140 msnm, Sep. 1989, *Luz Delgado 594* (holotype, MO; isotype, PORT). Figure 1.

Arbor usque 15 m alta; pagina inferior costae mediae anguste 2-alata ad angulos, minute puberula; cryptae stomatatae unaquaeque cavitatibus 1–5; epidermes folii sine pigmento; hypodermis absens; stamina monadelphica; ovarium 4-loculare ovulis 22–25 axillaribus; semen unicum, globosum.

Tree to 15 m high, glabrous except for the leaf midrib; young twigs rounded. Petioles 4.5–6 mm long; blades 7.9–12.4 cm long, 4.1–6 cm wide, ovate-elliptic to elliptic, acute at base, abruptly acuminate at the apex with an acuminum 0.7–1 cm long; midrib low-rounded to plane or slightly grooved adaxially when dry, prominent abaxially, flat and winged on the edges, the undermidrib minutely puberulent with hairs 20–40  $\mu\text{m}$  long; lateral nerves when dry faintly visible or invisible adaxially, faintly visible abaxially. Midrib xylem tubular; stomatal crypts 30–36 per  $\text{mm}^2$  near the margin to 54 near the midrib, with (1–)2–5 cavities each, 50–60  $\mu\text{m}$  high; adaxial epidermis of uniform thickness, 29–31  $\mu\text{m}$  thick including the cuticle, mostly one cell thick, occasionally two, mucilage walls none, the cytoplasm unpigmented and clear till stained, the inner walls straight and parallel with the outer ones; cuticle thin; abaxial epidermis also unpigmented; hypodermis none; foliar sclere-

ids all terminal on the veinlets, irregularly stellate, often with an irregular horizontal central body 1–4 times as long as wide. Peduncles 1 per side at leafless nodes of twigs 3–4 mm thick below the leaf zone, 10.5–14 mm long with 2 internodes, the lower 0.5–1 mm long, the upper 10–13 mm, 1-flowered; bracts deciduous before fruit formation; pedicels 12–13 mm long in fruit; ovary locules 4, placentation axile, ovules 4–11 per placenta, 22–25 in all; fruits yellow to orange, ellipsoid, crowned with the calyx, 17–18 mm long including calyx by 12–14 mm diam. when dry, 20–21 mm long by 13–16 mm when boiled, the fruiting calyx 6.4–6.7 mm diam., 3–3.3 mm deep, the lobes low-triangular, 0.8–1.2 mm high, 4–5.2 mm wide; seed 1, spheroid, 9.7–9.9 mm high, 8.8–9.6 mm thick, with an irregularly elliptic raised area (function unknown) ca. 4 mm from the broken chalazal strand, the raised area 6 mm long, 4 mm wide, 0.5–1 mm high, with edges that overhang 0–0.5 mm; the raised area presumably includes the micropyle. Petal scars on the fruit rounded-triangular, 2.3–2.7 mm wide, 0.9–1.2 mm long; stamen scars 8, the filament scars broad, thin, and united, forming a continuous ring 3.2–3.7 mm in outside diam., 0.2–0.5 mm thick, the stamens thus monadelphous; thecae adaxial on the filaments and placed low so that their bases leave imprints 0.9–1.2 mm wide, 0.8–1.0 mm thick radially around the style base, the total stamen thickness at base 1.0–1.3 mm.

**Distribution.** Known only from the type locality east of San Fernando de Atabapo, northwest of central Amazonas, Venezuela.

**Local name.** Cometure tierra firmero.

Although the type specimen bears only ripe fruits, the filament scars and anther imprints on the fruits yield useful floral information, and with careful dissection of the 1-seeded fruit (when boiled) all or most of the undeveloped ovules can be found and the nature of the placentation determined, in spite of the compaction and distortion that have taken place.

The new species is unique in the genus in its unpigmented epidermises. Further distinctions of this plant from the other species follow, starting



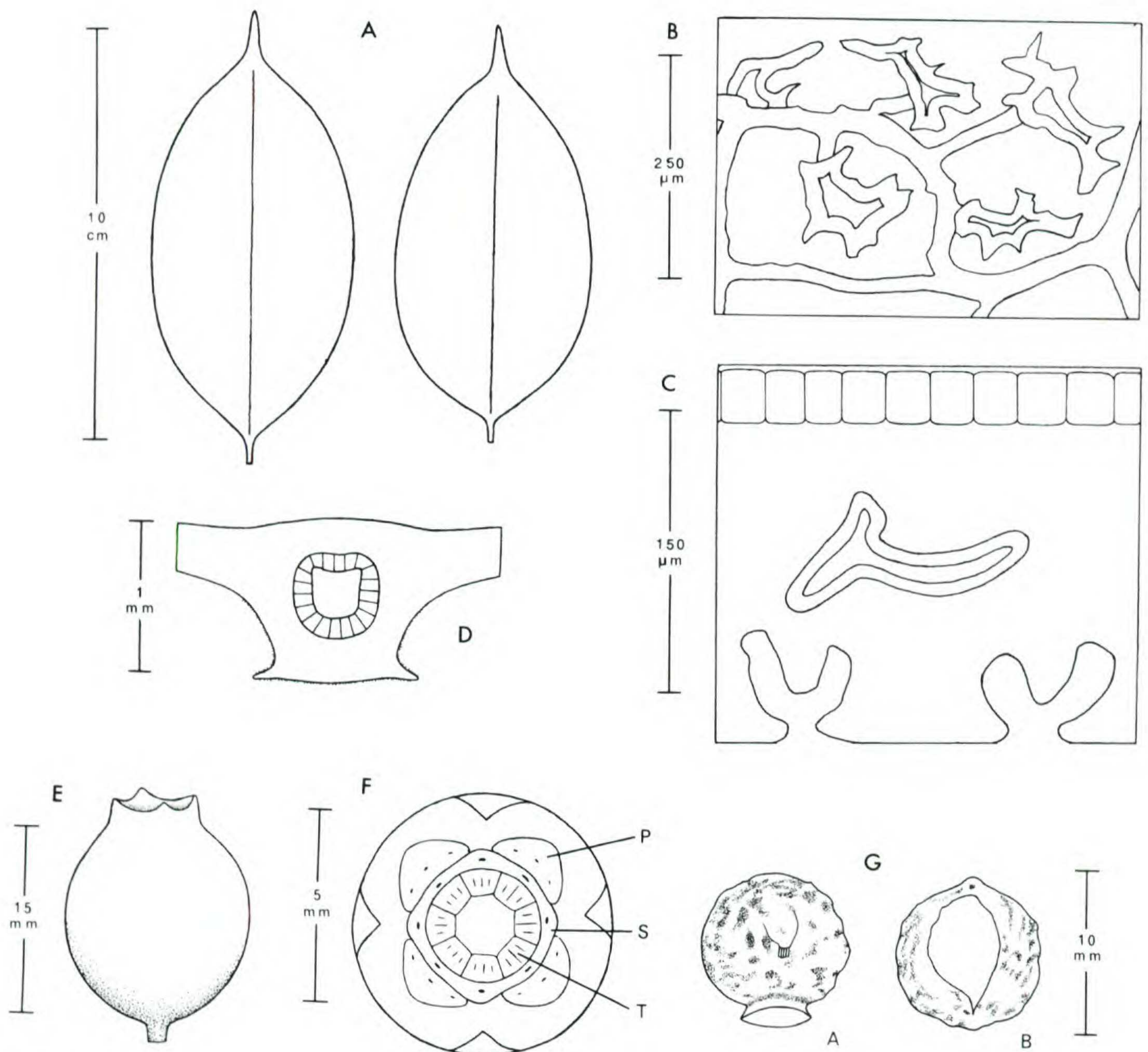


Figure 1. *Mouriri ventuarensis* Morley. —A. Leaves. —B. Cleared portion of leaf blade showing veins and terminal sclereids. —C. Cross section of leaf blade showing upper epidermis, a sclereid, and stomatal crypts. —D. Cross section of leaf midrib. —E. Fruit. —F. Apex of fruit showing the calyx lobes and the scars and imprints of the other floral appendages: P, petal scar; S, scar of monadelphous stamens; T, imprints of anther thecae. —G. Seed: A, broken chalazal strand shows halfway up; B, shape of elevated outgrowth is shown; the chalazal strand is at the top.

with those most easily and clearly distinguished: *V. pubescens* Morley differs in the pubescent underside of its lamina; *V. guianensis* Aublet, *V. monantha* (Urban) Morley, and *V. orinocensis* Morley have separate filaments and only 10 or fewer ovules per ovary; *V. monadelpha* (Ducke) Morley has 48 ovules per ovary and two very different forms of foliar sclereid; *V. plerocarpa* (Morley) Morley has 45 ovules per ovary, lateral nerves of the leaf moderately prominent, stomatal crypts 32–38  $\mu\text{m}$  high, an irregular upper epidermis in which the lower walls of the cells are mostly strongly rounded and variable in depth, and mucilage walls occasional in the epidermis; *V. orbinaxia* Morley has a glabrous unwinged midrib when viewed abaxially, separate

stamens, 36 ovules, and columnar sclereids. *Votomita cupuliformis* Morley & Almeda differs in its abaxially glabrous midrib, 16 ovules, simple stomatal crypts, columnar foliar sclereids, and epidermal cells with numerous mucilage walls. *Votomita roraimensis* Morley departs in having petioles 1.5–2.5 mm long, a seed lacking an elevated elliptic disc, 15–16 ovules, and a double epidermis with a deep inner layer and occasional mucilage walls.

Of the other species, the one most similar to *Votomita ventuarensis* is *V. plerocarpa*, which agrees in its abaxially puberulent midrib, the form of its foliar sclereids and stomatal crypts, its monadelphous stamens with low-placed thecae, and its axile placentation. The features differentiating *V. plero-*



*carpa* from *V. ventuarensis* are stated above. When flowering plants of the new species are found, and fruiting material of *V. plerocarpa* is collected, the differences between the two doubtless will become more apparent. As it is, the numerous anatomical features that occur in the genus greatly facilitate the distinctions between these two species as well as between all the species of the genus. Long experience has shown these features to be as reliable as morphological ones.

Although only two fruits of the new species could be dissected owing to scarcity of material, both were one-seeded even though there were 20–25 ovules present; one-seeded fruits are also found in the other species of the genus for which fruits are available: *V. guianensis* (9–10 ovules), *V. monantha* (5–8 ovules), *V. pubescens* (20–26 ovules), and *V. roraimensis* (15–16 ovules). All seeds are relatively large.

A similar pattern of ovule to seed number and large seed size occurs in the closely related genus *Mouriri* and in its Old World relatives. However, in *Mouriri* many species have more than one seed. *Mouriri trunciflora* Ducke has 40–80 ovules but only 2–12 seeds; *M. dimorphandra* Morley, 42–71 ovules and 2–5 seeds; *M. brachyanthera* Ducke, 54–57 and 2–4; *M. ficoides* Morley, 50–60 and 2–5; *M. subumbellata* Triana, 15–42 and 1–8; *M. crassifolia* Sagot, 30–38 and 1–6; *M. lunatanthera* Morley, 28–43 and 6; *M. cauliflora* Martius ex DC., 23–40 and 5 (Morley, 1976). All the rest with known flowers have 4–30 ovules and those with known fruits have 1–5 seeds except for *M. oligantha* Pilger, which has 9–12 ovules and 1–6 seeds; the ovules are always 3–20 times as many as the seeds, with the possible exception of *M. oligantha* (Morley, 1976). It is believed that the wide range in ovule numbers can be read as a form-series from many to few.

The Old World genera *Lijndenia*, *Memecylon*, *Spathandra*, and *Warneckea* are similar to *Votomita* in ovule and seed numbers. The flowers produce 2–19 ovules (Bremer, 1981, 1982, 1983; Jacques-Félix, 1978, 1984, 1985) but only 1(–2) seed(s). The consistently single seed of *Votomita* and the one or occasionally two seeds of the Old World genera agree with the interpretation of these on other grounds as generally more specialized than *Mouriri*.

It would appear that the consistent and apparently inefficient pattern in the Memecyleae in which one to many ovules do not function must result from a hormonal cut-off from the undeveloped ovules. The small number of ripened seeds, which are relatively large, must be somehow advantageous in relation to the final fruit size, the

nature of the fruit-eaters, and/or the conditions encountered by the dormant or germinating seed. The reduction in number of seeds per fruit must reflect some major shift in the ecology of the group.

In all probability the Memecyleae (see Renner, 1993) are evolving from a group in which the fruits have or had many small seeds with a matching ecology, with conditions apparently wasteful of ovules initially being produced as the ecological adaptation changed and evolution proceeded in the direction of few large seeds. Progressively fewer ovules are produced in the more advanced members: as few as five in one species of *Votomita*, four in a *Mouriri*, and two in some *Lijndenias*.

It was thought desirable to find a practical way to describe seed size since sizes vary greatly in the subfamily, particularly in *Mouriri*. Volume was judged to be the critical parameter. To determine the approximate volume the formula for the volume of an ellipsoid was used:  $\frac{1}{3}\pi \times (\frac{1}{2} \text{ length} \times \frac{1}{2} \text{ width} \times \frac{1}{2} \text{ thickness of the seed})$ . Even with some divergence from a true ellipsoid this formula should give a useful approximation of size.

In order to make a limited check on the accuracy of the above method, displacement tests were made with the relatively few seeds of *Mouriri* and *Votomita* available at the MIN herbarium. Seeds of 15 species were measured by placing them in 95% EtOH in standard graduated cylinders of three sizes and measuring the fluid rise. The accuracy of this method is limited by the difficulty of getting an exact reading of fluid level, especially when the seed is a poor fit in the tube. In 11 of the 15 seeds the figure calculated from measurements was between 1 and 10% of the displacement figure, from low to high. The exceptions were 11%, 14%, and 21% high, the 21% being a seed covered with irregular tubercles (the seeds were calipered). I conclude that at least in the Memecyleae the measurements calculated by formula are accurate within 10% of the true volume in most cases and rarely exceed a differential of 20%.

With one exception the largest seeds in *Mouriri* occur in the two most primitive sections, *Taphroxylon* and *Abundiflos*, where approximate seed volumes range from (34–)777 to 3041 mm<sup>3</sup>. The exception is *M. megasperma* Morley, which has a volume of 3806 mm<sup>3</sup>, the largest known seed in the genus; known only in fruit, the relations of this species are uncertain except that it is a specialized plant and is not in either of the aforementioned sections. Seed volumes in *Mouriri* other than in the two most primitive sections or *M. megasperma* vary from 39 to 1341 mm<sup>3</sup>. Only two species, *M. arborea* Gardner and *M. crassisepala* Morley, have seeds ex-



ceeding 780 mm<sup>3</sup>. The smallest seeds are those of *M. viridicosta* Morley, 34 mm<sup>3</sup>, an anomalous member of the section *Taphroxylon*; next smallest are seeds of *M. helleri* Britton, 39 mm<sup>3</sup>. Seed volumes in the five species of *Votomita* known in fruit range from 56 to 493 mm<sup>3</sup>. The four Old World genera are estimated from illustrations or published dimensions to have seed volumes of about 20–680 mm<sup>3</sup>.

Since the largest seeds of *Mouriri* occur mostly in the most primitive sections it is possible that large seed size played a part in the origin of the subfamily. It has been suggested that larger seeds favor survivability of the seeds or seedlings (Richards, 1996; Howe, 1986), and it is stated that the large-seeded local species in a study area at Los Tuxtlas, Mexico, have higher establishment rates in the closed canopy forests there than smaller-seeded plants (Martinez-Ramos & Soto-Castro, 1993). Howe (1993) made the general observation that trees with specialized dispersal systems often have large seeds. However, as van der Pijl pointed out (1969), “. . .small and large seeds have many backgrounds!” This last point is illustrated in *Mouriri*, where most of the species with large seeds occur in the two most primitive groups, but one species, *M. megasperma*, appears to have evolved large seeds secondarily in an advanced group.

The general trend in the Memecyleae toward reduction in number of seeds suggests either that a one-seeded fruit makes the most desirable package for convenient frugivore dispersal, or that the plant resources would not permit ripening many large seeds in the same fruit, or perhaps a combination of the two. Unknown factors are probably involved.

The existence in the Memecyleae of plants with

many ovules, presumably a primitive condition, suggests that any search for its ancestral connections should be among groups that also have numerous ovules.

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